Section 7: Technology Education
2008-2009

- Course Descriptions
- Course Sequences
- Career Clusters

September 2008

Section 7: Technology Education
Course Descriptions, Sequences, Career Clusters

Section Overview

This section presents course information applicable to the Technology Education program area: course descriptions, course concentration sequences, and career clusters. Following the course description, the remainder of the information for each course is presented in a table. The definitions and criteria below are summarized to clarify and enhance the table components.

Sequences

- A *concentration* is a coherent sequence of courses completed by a student in a specific career area as identified in this planning guide. (A sequence may be comprised of two 36-week courses, one 36-week course and two 18-week courses, or four 18-week courses.)
- A career and technical education *completer* is a student who has met the requirements for a career and technical concentration and all requirements for high school graduation or an approved alternative education program. Students may take additional career and technical education courses that will enhance their career pathway goals.
- A *specialization* is a choice by a student to specialize in an occupational field by taking additional courses in a specific career area as appropriate to his/her career pathway.

Certifications/Licenses/Assessments Available

Completion of certain courses enables students to apply for industry certification, a state license, and/or a national certification. These credentials are beneficial (and sometimes essential) to students seeking employment in a career field or occupational specialty. In addition, students who obtain these credentials earn verified credits toward graduation.

- A *standard credit* is based on a minimum of 140 clock hours of instruction and successful completion of the requirements of the course.
- A *verified credit* is based on a standard credit plus a passing score on the end-of-course SOL test (or other test as described in the Standards of Accreditation 8 VAC 20-131-110). A standard credit may not be verified more than once.
- A *student-selected verified credit* is a course credit that includes a test (other than SOL) approved by the Virginia Board of Education.

For students to be eligible to receive student-selected verified credits, their teacher must be certified by the issuing organization relative to the industry certification or licensure. In the case of a CTE program area where there are potential multiple certifications, the teacher must be certified in at least one industry certification that is related to the course and/or course sequence. ***Exception:*** There is no teacher certification requirement for students to receive verified credits upon passing a selected NOCTI assessment related to their CTE program.

Verified credits entitle students to the Career and Technical Education diploma seal. Some verified credits earn students the Advanced Mathematics and Technology seal. Each year, the Virginia Board of Education approves the industry certifications that enable students to earn these seals.

The relationships among Board-approved examinations, verified credits, and diploma seals are explained in the Introduction and in Section 9. Additional information, including the description of each credential, how to earn it, and courses that may prepare students for examination, is contained in Section 10: Course Index and Descriptions of Certifications, Licenses, and Assessments.

Career Clusters

To help students investigate careers and design their courses of study to advance their career goals, the Office of Career and Technical Education Services in Virginia has adopted the nationally accepted structure of 16 career clusters, their accompanying career pathways, and their sample career specialties or occupations. To simplify federal reporting, the *Career and Technical Education Reporting System (CTERS) User's Manual* assigns a career cluster to each course. The cluster is also listed with each course that follows. Because some career clusters overlap (have similar occupations), teachers may have a choice of more than one cluster and should select the most appropriate one based on the student's career pathway for their federal report.

Additional information and samples of how to use career clusters to select CTE courses are included in Section 11: Instructional Planning with Career Clusters, Career Pathways, and Occupations.

Elementary School Courses

Children begin in early education to lay a foundation for career development through rigorous courses in academics. As an example, academic courses offer information about different jobs and the basic concepts of economics, work ethics, and career choice. In addition, career and technical education offers instruction to elementary school students to help them prepare for future roles and responsibilities.

Technology Awareness 8410
Technology Education experiences in the elementary school are designed to help children learn and achieve the educational goals of the total elementary school program. These experiences orient children to technology, develop psychomotor skills, and provide the basis for informed attitudes about technology's influence on society. Technology-based activities, integrated into the total elementary school curriculum, motivate children and reinforce learning while children gain a degree of technological awareness.

Middle School Courses

Completer sequences and certifications do not apply to middle school courses. Report in the designated career cluster.

Introduction to Technology 8483 (36 weeks)
Introduction to Technology 8482 (18 weeks)
Introduction to Technology 8484 (12 weeks)
Introduction to Technology 8481 (9 weeks)

Suggested Grade Level(s): 6

Students first study the basic elements of all technology, including processes, energy, information, and people. They explore up to six systems of technology, including biotechnology, energy, construction, transportation, communication, and production/manufacturing. Finally, they relate the impact of technology on society, environment, and culture to future consequences and decisions. **(Science, Technology, Engineering and Mathematics career cluster)**

Inventions and Innovations 8461 (36 weeks)
Inventions and Innovations 8464 (18 weeks)
Inventions and Innovations 8485 (12 weeks)

Suggested Grade Level(s): 7

Students make models of significant inventions that have advanced society. After studying these developments, they explore contemporary technological problems facing them, their community, or the world and apply systematic procedures to invent new products or innovations as solutions. **(Science, Technology, Engineering and Mathematics career cluster)**

Technological Systems 8462 (36 weeks)
Technological Systems 8463 (18 weeks)
Technological Systems 8486 (12 weeks)

Suggested Grade Level(s): 8

Students combine resources and techniques into systems, realizing technology as a system. By simulating systems, assessing their impacts, and relating this experience to the two previous levels, students gain an insight into how to approach the problems and opportunities of a technological world in a broad sense. They also explore occupational areas and educational programs for technology-oriented careers. **(Science, Technology, Engineering and Mathematics career cluster)**

High School Course Credit in Middle School

Local school divisions may offer certain high school courses to students in middle school and award secondary credit to those students who master the **secondary** state-approved course competencies. The following Technology Education courses may be offered in middle school for secondary credit:

Geospatial Technology I 8423

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

The Geospatial Technology program provides experiences pertaining to the study of geographic information systems (GIS), global positioning systems (GPS), remote sensing (RS), digital image processing simulator (DIPS), Geodesy, automated cartography (Auto-Carto), land surveying (LS), and navigation. Fundamentally, these technologies allow students to explore and analyze the natural and human-made world, from local to global and beyond. Students will use various tools, processes, and techniques to create, store, access, manipulate, and revise data to solve human challenges. These experiences will employ real-world spatial analysis models and guidelines for integrating, interpreting, analyzing, and synthesizing data, with a focus on both the implications and the limitations of such technologies. These experiences also include the interfacing to telecommunications and automated database management systems. **(Information Technology career cluster)**

Materials and Processes Technology 8433

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Materials and Processes Technology 8478

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

Students focus on industrial/technical materials and processes as they fabricate usable products and conduct experiments. Learning experiences include career analysis as well as the use of tools and equipment related to analysis, testing, and processing of metals, plastics, woods, ceramics, and composite materials. This course is recommended for students interested in technical careers and others wishing to improve their consumer knowledge and technological literacy. **(Manufacturing career cluster)**

Technology Foundations 8403

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Technology Foundations 8402

Suggested Grade Level(s): 9, 10, 11, 12 (18 weeks)

In this beginning high school course, students acquire a foundation in technological material, energy, and information and apply processes associated with the technological thinker. Challenged by laboratory activities, students create new ideas and innovations, build systems, and analyze technological products to learn further how and why technology works. They work in groups to build and control systems using engineering design in the development of a technology. **(Science, Technology, Engineering and Mathematics career cluster)**

Course Offerings

Advanced Drawing and Design 8438

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Students use a graphic language for product design and technical illustration. They increase their understanding of drawing techniques learned in the prerequisite courses. They research design-related fields while identifying the role of advanced drawing and design in manufacturing and construction industry processes. They apply the design process, analyze design solutions, reverse engineer products, create 3-D solid models using CADD, construct physical models, and create multimedia presentations of finished designs. They complete a work portfolio based on a chosen graphic project.

Concentration Sequences **(a combination of the course above and those below, equivalent to two 36-week courses)** **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Architectural Drawing and Design 8437 • Digital Visualization 8459 • Engineering Drawing and Design 8436	Architecture and Construction	See Section 10 for a listing of applicable credentials (by course name or credential name).

Advanced Engineering 8491

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Introduction to Engineering 8490

To learn the applications and design process of engineering, students form engineering teams and select a group design problem. Each team uses communications, graphics, mathematics, and community resources to solve problems. Each team learns appropriate information in order to complete a project. Projects may be models, systems, or products that creatively solve an engineering problem.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Introduction to Engineering 8490	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Advanced Technology Studies 8466 (36 weeks)

Contact the Technology Education Service, Virginia Department of Education, for information on this course. **(Science, Technology, Engineering and Mathematics career cluster)**

Aerospace Technology I 8487

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Aerospace Technology I is an introduction to flight, space travel, and supporting technologies. Students will use a hands-on approach to study concepts including the history of aviation, aerodynamics, aircraft components, flight conditions, airport and flight operations, space, rocketry, and the aviation and space industries.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Aerospace Technology II 8488	Transportation, Distribution and Logistics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Aerospace Technology II 8488

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Aerospace Technology I 8487

Aerospace Technology II is an advanced exploration of flight, space travel, and supporting technologies. Students will use a hands-on approach to study concepts including aerospace activities; aircraft design, control, safety, and maintenance; airport infrastructure; rocket technology; space systems; and living and working in the aerospace environment.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Aerospace Technology I 8487	Transportation, Distribution and Logistics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Architectural Drawing and Design 8437

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Architectural Drawing and Design 8492

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

Prerequisite(s): Technical Drawing and Design 8435

Students learn the principles of architecture and increase understanding of working drawings and construction techniques learned in the prerequisite course. Experiences include residential and commercial building designs, rendering, model making, structural details, and community planning. Students use computer-aided drawing and design (CAD) equipment and established standards or codes to prepare models for presentation. The course provides information helpful for the homeowner and is especially beneficial to the future architect, interior designer, or homebuilder.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Advanced Drawing and Design 8438 • Digital Visualization 8459 • Engineering Drawing and Design 8436/8493* **18-week course*	Architecture and Construction	See Section 10 for a listing of applicable credentials (by course name or credential name).

Bioengineering 8467

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Biotechnology Foundations 8468

The study of bioengineering combines engineering, medicine and other biological sciences. Students explore the process of designing and producing a variety of bio-based products. Student research and problem-based activities include (1) designing artificial limbs and other organ substitutes, and (2) producing and testing electronic instruments and advanced equipment used in biotechnology.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Biotechnology Foundations 8468	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Biotechnology Foundations 8468

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

This course focuses on various techniques that are used to modify living organisms, or parts of organisms, to improve plants and animals, and the development of microorganisms for specific purposes. Student activities range from bioprocessing and genetic engineering to medicine, biomechanical systems, and the environment. Students gain insight and understanding about biotechnology career fields.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Bioengineering 8467	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Communication Systems 8415

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Communication Systems 8418

Suggested Grade Level(s): 9, 10, 11, 12 (18 weeks)

This course provides experiences related to various modes of communicating information, using data, technical design, optics, graphic production, audio and video, and integrated systems. Students solve problems involving input, process, output, and feedback processes. Also, students learn about potential career choices related to communication and the impact of communication on society.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Computer Control and Automation 8421/8420* • Geospatial Technology 8423 • Graphic Communications Systems 8458/8494* • Imaging Technology 8455 • Video and Media Technology 8497 **18-week course*	Information Technology	See Section 10 for a listing of applicable credentials (by course name or credential name).

Computer Control and Automation 8421

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Computer Control and Automation 8420

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

Students engage in a broad study of the technical aspects of computers and their applications to production, transportation, and communication systems. Topics include computer equipment and operating systems, programming, control processing information, and social/cultural impact of computers. Problem-solving activities challenge students to plan, program, and interface devices with computer systems. Learning activities include experiences with robotics and control systems, computer-aided design, and computer-aided manufacturing.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Communication Systems 8415/8418* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Computer Integrated Manufacturing 8442

Suggested Grade Level(s): 11 or 12 (36 weeks)

This pre-engineering course is designed to follow three core courses (Principles of Engineering, Introduction to Engineering Design, and Digital Electronics) as part of a national engineering program. Students learn concepts of robotics and automated manufacturing by creating three-dimensional designs with modeling software and producing models of their designs. Students use CNC equipment to produce actual models of their three-dimensional designs. Fundamental concepts of robotics used in automated manufacturing and design analysis are included.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Digital Electronics 8440 • Principles of Engineering 8441	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Construction Technology 8431

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Construction Technology 8432

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

In this single-period laboratory course, students design, build, and test scale-model structures and work with projects that help them to understand the jobs of architects, carpenters, electricians, plumbers, surveyors, contractors, masons, design engineers, and a variety of other construction careers. (This course is a companion to Manufacturing Systems.)

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Production Systems 8447/8446* • Materials and Processes Technology 8433/8478* • Manufacturing Systems 8425/8426* **18-week course*	Architecture and Construction	See Section 10 for a listing of applicable credentials (by course name or credential name).

Digital Electronics 8440

Suggested Grade Level(s): 10 or 11 (36 weeks)

This pre-engineering course is designed to follow two core courses (Principles of Engineering and Introduction to Engineering Design) as part of a national engineering program.Students use computer simulations to learn about the logic of electronics as they design, test, and actually construct circuits and devices. They apply control system programming and explore sequential logic and digital circuitry fundamentals. Topics in computer circuitry are also presented, including circuitry analysis and an exploration into diodes, transistors, and operational amplifiers.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Introduction to Engineering Design 8439 • Principles of Engineering 8441	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Digital Visualization 8459

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Prerequisite(s): Technical Drawing and Design 8435

Students gain experiences related to computer animation by solving problems involving 3-D object manipulation, storyboarding, texture mapping, lighting concepts, and environmental geometry. They produce animations that include interdisciplinary projects related to science, engineering, and the entertainment industry. A major emphasis is the production of a portfolio that showcases examples of original student work.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Architectural Drawing and Design 8437/8492* • Engineering Drawing and Design 8436/8493* • Technical Drawing and Design 8435/8434* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Electronics Systems I 8416 (36 weeks)
Electronics Systems I 8417 (18 weeks)

Suggested Grade Level(s): 9, 10, 11, 12

This course engages students in electricity and electronic experiments that focus on the application of scientific theories and mathematics principles. Students solve problems using simple electrical devices and circuits and build electronic projects using DC and AC devices and circuits.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Computer Control and Automation 8421/8420* • Electronics Systems II 8412 **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Electronics Systems II 8412

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Prerequisite(s): Electronics Systems I 8416

Students work with electronics devices, instruments, and circuits, building projects to apply theories and laws with electronic components such as resistors, capacitors, and transistors. They also study integrated circuits used in computers, amplifiers, television, and other equipment.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Electronics Systems I 8416	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Electronics Systems III 8413

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Electronics Systems II 8412

Electronics III teaches advanced electronic concepts, focusing on cutting-edge digital electronics, microprocessors, and automation. Students analyze emerging technologies related to the electronics industry while studying theory, using electronic test equipment, and investigating careers related to electrical engineering.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
This course may be offered as a complement to an existing concentration sequence.	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Energy and Power 8448

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Energy and Power 8495

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

In this single-period laboratory course, students learn about the application of power and energy systems to common power devices and transportation vehicles and apply theory to the practical servicing of common machines such as small gasoline engines, outboard motors, motorcycles, and lawn mowers.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Electronics Systems I 8416/8417* • Power and Transportation 8445/8444* **18-week course*	Transportation, Distribution and Logistics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Analysis and Applications 8451

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Prerequisite(s): Engineering Explorations 8450

Engineering Analysis and Applications is the second of a possible four-course sequence that will allow students to examine systems, the interaction of technology and society, ethics in a technological world, and the fundamentals of modeling while applying the engineering design process to areas of the designed world. Students will participate in hands-on projects in a laboratory setting as they communicate information through team-based presentations, proposals, and technical reports.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Engineering Explorations 8450	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Concepts and Processes 8452

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Engineering Analysis and Applications 8451

Engineering Concepts and Processes is the third course of a four-course sequence that will enable students to examine technology and engineering fundamentals related to solving real-world problems. This course focuses on building an engineering team, working with case studies, managing projects, applying logic and problem-solving skills, delivering formal proposals and presentations, and examining product and process trends. In addition, students continue to investigate a variety of engineering specialty fields and related careers to determine whether they are good candidates for post-secondary educational opportunities in engineering.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Engineering Practicum 8453	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Design and Development 8443

Suggested Grade Level(s): 12 (36 weeks)

This pre-engineering course is designed to follow three core courses (Principles of Engineering, Introduction to Engineering Design, and Digital Electronics) as part of a national engineering program. Students enrolled in the Engineering Design and Development course synthesize knowledge, skills, and abilities through an authentic engineering experience. Students are expected to develop and formally present an independent study project and a team-oriented project, which are critiqued by an evaluation committee. Students interact and work with community mentors to research, design, and construct solutions to engineering problems.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Aerospace Technology I 8487 • Bioengineering 8467 • Computer Integrated Manufacturing 8442	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Drawing and Design 8436

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Engineering Drawing and Design 8493

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

Prerequisite(s): Technical Drawing and Design 8435

Students use a graphic language for product design, technical illustration, assembly, patent, and aeronautical drawings. They increase their understanding of drawing techniques learned in the prerequisite course. Students use computers, calculators, and descriptive geometry and adhere to established standards to solve design problems. Throughout the course, they hold seminars, meet engineers, and tour technical design firms in order to learn about the benefits of the course on their future study and career. Completion of this course may contribute to a student's preparation for AutoCAD certification examination.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Architectural Drawing and Design 8437/8492* • Digital Visualization 8459 • Technical Drawing and Design 8435/8434* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Explorations 8450

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Engineering Explorations is the first course of a possible four-course sequence that will enable students to examine technology and engineering fundamentals related to solving real-world problems. Students will be exposed to a variety of engineering specialty fields and related careers to determine whether they are good candidates for post-secondary educational opportunities in engineering. Students will gain a basic understanding of engineering history and design, using mathematical and scientific concepts. Students will participate in hands-on projects in a laboratory setting as they communicate information through team-based presentations, proposals, and technical reports.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Engineering Analysis and Applications 8451	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Engineering Practicum 8453

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Engineering Concepts and Processes 8452

Engineering Practicum is the fourth course of a four-course sequence that will enable students to examine technology and engineering fundamentals related to solving real-world problems. To do so, students examine ethics and intellectual property and design a practicum project, a culmination of knowledge and skill they gained in the previous engineering courses. In addition, students continue to investigate a variety of engineering specialty fields and related careers to determine whether they are good candidates for post-secondary educational opportunities in engineering.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Engineering Concepts and Processes 8452	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Entrepreneurship Education 9094

Suggested Grade Level(s): 11 or 12 (36 weeks)

This course is designed for students who wish to concentrate on strategies for career development through ownership/management of their own businesses. Although individual skills are emphasized, the focus of the course is on development of a business plan, including the following: Determination of type of business enterprise, legal considerations, location selection, financing, steps in getting the enterprise started, marketing strategy, and interaction with successful entrepreneurs. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved marketing position with continuing supervision throughout the school year.

Note: Entrepreneurship Education, a Career Connections course, may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

Exploring Entrepreneurship 9093

Suggested Grade Level(s): 9, 10, 11, 12 (18 weeks)

Students explore qualities of individual enterprise, or the art of succeeding in a career. They develop skills needed to advance in an ever-changing work environment. Specifically, students develop competencies in decision making, long-range planning, effective communication, accountability, responsibility, and continuing education.

Note: Exploring Entrepreneurship, a Career Connections course, may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

Geospatial Technology I 8423

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

The Geospatial Technology program provides experiences pertaining to the study of geographic information systems (GIS), global positioning systems (GPS), remote sensing (RS), digital image processing simulator (DIPS), Geodesy, automated cartography (Auto-Carto), land surveying (LS), and navigation. Fundamentally, these technologies allow students to explore and analyze the natural and human-made world, from local to global and beyond. Students will use various tools, processes, and techniques to create, store, access, manipulate, and revise data to solve human challenges. These experiences will employ real-world spatial analysis models and guidelines for integrating, interpreting, analyzing, and synthesizing data, with a focus on both the implications and the limitations of such technologies. These experiences also include the interfacing to telecommunications and automated database management systems.

Note: This course may be offered to middle school students for high school credit if approved by the local school division.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Communication Systems 8415 • Imaging Technology 8455	Information Technology	See Section 10 for a listing of applicable credentials (by course name or credential name).

Graphic Communications Systems 8458

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Graphic Communications Systems 8494

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

This course provides experiences related to a wide range of tools and materials used to reproduce information and images. Several mediums are used, including paper, metal, plastic, and fabric. Students develop competencies in message design, composition and assembly, film conversion and assembly, and message transfer and product conversion.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Communication Systems 8415/8418* • Imaging Technology 8455 **18-week course*	Arts, Audio/Video Technology and Communications	See Section 10 for a listing of applicable credentials (by course name or credential name).

Imaging Technology 8455

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Imaging Technology introduces students to the basic principles of photography while providing a strong emphasis on digital imaging. Students study the development of photography as a communication medium and its evolution into the digital realm. Students learn to use image-editing software to manipulate digital images.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Communication Systems 8415 • Geospatial Technology I 8423 • Graphic Communications Systems 8458 • Video and Media Technology 8497	Arts, Audio/Video Technology and Communications	See Section 10 for a listing of applicable credentials (by course name or credential name).

Industrial Occupational Exploration 8472 (36 weeks); 8473 (18 weeks)

Contact the Technology Education Service, Virginia Department of Education, for information on this course. **(Science, Technology, Engineering and Mathematics career cluster**)

Information Technology in Production Systems 8496

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Information Technology in Production Systems provides experiences pertaining to the core elements of information technology (information services and support, network systems, programming and software development, and interactive media) with an emphasis on the following technical systems: communication, construction, manufacturing, transportation, and biotechnology. Students also work in teams to gain an understanding of the ways information-based projects are managed and implemented in various career fields.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Advanced Manufacturing Systems 8427 • Computer Control and Automation 8421 • Construction Technology 8431 • Manufacturing Systems 8425 • Production Systems 8447	Manufacturing	See Section 10 for a listing of applicable credentials (by course name or credential name).

Introduction to Engineering 8490

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

While undergoing an orientation to the careers and challenges of engineering, students are actively involved with high-tech devices, engineering graphics, and mathematical concepts and scientific principles through problem-solving experiences. Activities in descriptive geometry, materials science, and technical systems challenge students as they communicate information through seminars, technical reports, and idea sharing.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Advanced Engineering 8491	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Introduction to Engineering Design 8439

Suggested Grade Level(s): 9 or 10 (36 weeks)

This pre-engineering course is one of three core courses (along with Principles of Engineering and Digital Electronics) in a national engineering program. Using computer-modeling software, students learn the design process. They solve design problems as they develop, create, and analyze product models.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Principles of Engineering 8441 • Digital Electronics 8440	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Introduction to Leadership 9091

Suggested Grade Level(s): 9 or 10 (18 weeks)

This course equips students with individual and group leadership skills. Course content includes leadership principles, officer training, parliamentary law, public speaking, effective communication, positive public relations skills, and techniques of organizing and conducting group meetings and activities. Students are encouraged to be active members of a community or school organization.

Note: Introduction to Leadership, a Career Connections course, may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

Introduction to Technology 8483 (36 weeks) **(Middle School)**
Introduction to Technology 8482 (18 weeks) **(Middle School)**
Introduction to Technology 8484 (12 weeks) **(Middle School)**
Introduction to Technology 8481 (9 weeks) **(Middle School)**

Suggested Grade Level(s): 6

Students first study the basic elements of all technology, including processes, energy, information, and people. They explore up to six systems of technology, including biotechnology, energy, construction, transportation, communication, and production/manufacturing. Finally, they relate the impact of technology on society, environment, and culture to future consequences and decisions. **(Science, Technology, Engineering and Mathematics career cluster**)

Note: Completer sequences and certifications do not apply.

Inventions and Innovations 8461 (36 weeks) **(Middle School)**
Inventions and Innovations 8464 (18 weeks) **(Middle School)**
Inventions and Innovations 8485 (12 weeks) **(Middle School)**

Suggested Grade Level(s): 7

Students make models of significant inventions that have advanced society. After studying these developments, they explore contemporary technological problems facing them, their community, or the world and apply systematic procedures to invent new products or innovations as solutions. **(Science, Technology, Engineering and Mathematics career cluster**)

Note: Completer sequences and certifications do not apply.

Leadership Development 9096

Suggested Grade Level(s): 11 or 12 (18 weeks)

Leadership Development 9097

Suggested Grade Level(s): 11 or 12 (36 weeks)

Students develop competencies in identifying individual aptitudes in relation to effective leadership skills, understanding organizational behavior, using effective communication in the workplace, handling human resources and organizational problems, supervising and training employees, resolving conflict, and planning for the future. Continuing education in leadership is emphasized as well as practical leadership experiences in cooperation with school and community leaders.

Note: Leadership Development, a Career Connections course, may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

Manufacturing Systems 8425

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Manufacturing Systems 8426

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

This course provides an orientation to careers in various fields of manufacturing. Emphasis will be placed on the major systems in automated manufacturing, including design, electrical, mechanical, manufacturing processes, material handling, and quality control. Students participate in teams to produce manufacturing projects that demonstrate critical elements of manufacturing.

Concentration Sequences **(a combination of the course above and those below, equivalent to two 36-week courses)** **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Computer Control and Automation 8421/8420* • Construction Technology 8431/8432* • Manufacturing Systems, Advanced 8427 • Materials and Processes Technology 8433/8478* • Production Systems 8447/8446* **18-week course*	Manufacturing	See Section 10 for a listing of applicable credentials (by course name or credential name).

Manufacturing Systems, Advanced 8427

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Manufacturing Systems 8425

Students develop an in-depth understanding of automation and its applications in manufacturing. Activities center on flexible manufacturing processes and computer integrated manufacturing (CIM). Students work in teams to solve complex interdisciplinary problems that stem from the major systems in automated manufacturing.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Manufacturing Systems 8425	Manufacturing	See Section 10 for a listing of applicable credentials (by course name or credential name).

Materials and Processes Technology 8433

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Materials and Processes Technology 8478

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

Students focus on industrial/technical materials and processes as they fabricate usable products and conduct experiments. Learning experiences include career analysis as well as the use of tools and equipment related to analysis, testing, and processing of metals, plastics, woods, ceramics, and composite materials. This course is recommended for students interested in technical careers and others wishing to improve their consumer knowledge and technological literacy.

Note: This course may be offered to middle school students for high school credit if approved by the local school division.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Construction Technology 8431/8432* • Manufacturing Systems 8425/8426* • Production Systems 8447/8446* **18-week course*	Manufacturing	See Section 10 for a listing of applicable credentials (by course name or credential name).

Power and Transportation 8445

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Power and Transportation 8444

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

Students survey the many broad sources of energy and power used in power and transportation systems. Instruction in this single-period course includes ways that (1) energy is converted to power; (2) power is transmitted and controlled; and (3) power is used through mechanical, fluid, and electrical devices. Students explore career opportunities in power and transportation fields and build projects, conduct experiments, and repair mechanical devices such as small engines, electrical motors, and outboard motors.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Electronics Systems I 8416/8417* • Energy and Power 8448/8495* **18-week course*	Transportation, Distribution and Logistics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Principles of Engineering 8441

Suggested Grade Level(s): 9 (36 weeks)

This pre-engineering course is one of three core courses (along with Introduction to Engineering Design and Digital Electronics) in a national engineering program. Students in Principles of Engineering develop an understanding of the engineering profession and the fundamental aspects of engineering problem solving. Students study the historical and current impacts of engineering on society as well as ethical implications. Mathematical and scientific concepts will be applied to fundamental engineering topics, including mechanics and electrical circuit theory.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Introduction to Engineering Design 8439 • Digital Electronics 8440	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Principles of Technology I 9811

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Students in this single-period laboratory science course apply physics and mathematics concepts through a unified systems approach to develop a broad knowledge base of the principles underlying modern technical systems. Students study seven technical principles: force, work, rate, resistance, energy, power, and force transformers, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This “principles and systems” approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Principles of Technology II 9812	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Principles of Technology II 9812

Suggested Grade Level(s): 11 or 12 (36 weeks)

Prerequisite(s): Principles of Technology I 9811

Students continue to apply physics and mathematics concepts through a unified systems approach to expand their knowledge base of the principles underlying modern technical systems. This course focuses on seven technical principles: momentum, waves, energy converters, transducers, radiation, optical systems, and time constants, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This “principles and systems” approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

Note: Students who complete Principles of Technology I and Principles of Technology II may use these courses to satisfy one physics credit in laboratory science. A student must complete both courses in the sequence in order to receive laboratory science credit. The sequence of Principles of Technology I 9811 and Principles of Technology II 9812 will satisfy one unit of credit in laboratory science for physics and one elective credit. Students who enroll in Principles of Technology courses for a physics credit must have completed Algebra I and two other laboratory science courses as specified by the accrediting standards prior to enrolling in Principles of Technology.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Principles of Technology I 9811	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Production Systems 8447

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Production Systems 8446

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

Students assess the relationship between production and society as they compose design portfolios, construct production prototypes, and apply automation to evaluate their solutions to technological problems.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Construction Technology 8431/8432* • Materials and Processes Technology 8433/8478* • Manufacturing Systems 8425/8426* **18-week course*	Manufacturing	See Section 10 for a listing of applicable credentials (by course name or credential name).

Technical Drawing and Design 8435

Suggested Grade Level(s): 9, 10, 11 (36 weeks)

Technical Drawing and Design 8434

Suggested Grade Level(s): 9, 10, 11 (18 weeks)

In this foundation course, students learn the basic language of technical design, and they design, sketch, and make technical drawings, models, or prototypes of real design problems. The course is especially recommended for future engineering and architecture students.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Architectural Drawing and Design 8437/8492* • Engineering Drawing and Design 8436/8493* • Digital Visualization 8459 **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Technological Systems 8462 (36 weeks) **(Middle School)**
Technological Systems 8463 (18 weeks) **(Middle School)**
Technological Systems 8486 (12 weeks) **(Middle School)**

Suggested Grade Level(s): 8

Students combine resources and techniques into systems, realizing technology as a system. By simulating systems, assessing their impacts, and relating this experience to the two previous levels, students gain an insight into how to approach the problems and opportunities of a technological world in a broad sense. They also explore occupational areas and educational programs for technology-oriented careers. **(Science, Technology, Engineering and Mathematics career cluster)**

Note: Completer sequences and certifications do not apply.

Technology Assessment 8407

Suggested Grade Level(s): 11 or 12 (36 weeks)

Technology Assessment 8406

Suggested Grade Level(s): 11 or 12 (18 weeks)

Prerequisite(s): Technology Transfer 8405

Technology Assessment is offered as a capstone course for students in high school. Students use their knowledge and abilities in technology, mathematics, science, and other disciplines to analyze the impacts of technological devices and systems on the world. Students use information they acquire through activities and research to predict the future. They use computers and assessment activities to analyze products and systems to determine their possible impacts. They design and present their newly created products or systems.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Technology Foundations 8403/8402* • Technology Transfer 8405/8404* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Technology Awareness (Grades K-5) 8410 (36 weeks)

Contact the Technology Education Service, Virginia Department of Education, for information on this course. **(Science, Technology, Engineering and Mathematics career cluster)**

Technology Education–Disabled 8471

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

This course is designed to provide occupational exploration for students interested in various fields, such as those found in the career and technical education programs, while in a laboratory setting. Building upon previous experiences in the technology education program (both middle- and high-school levels), students are given the opportunity to link the study of technology to various jobs/careers.

Note: The career cluster will be determined by other courses taken in conjunction with this course to develop a concentration sequence.

Technology Education–Disadvantaged 8469

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

This course is designed to provide occupational exploration for students interested in various fields, such as those found in the career and technical education programs, while in a laboratory setting. Building upon previous experiences in the technology education program (both middle- and high-school levels), students are given the opportunity to link the study of technology to various jobs/careers.

Note: The career cluster will be determined by other courses taken in conjunction with this course to develop a concentration sequence.

Technology Education Dual Enrollment with Postsecondary 8498 (36 weeks)

Contact the Technology Education Service, Virginia Department of Education, for information on this course. **(Science, Technology, Engineering and Mathematics career cluster)**

Technology Foundations 8403

Suggested Grade Level(s): 9, 10, 11, 12 (36 weeks)

Technology Foundations 8402

Suggested Grade Level(s): 9, 10, 11, 12 (18 weeks)

In this beginning high school course, students acquire a foundation in technological material, energy, and information and apply processes associated with the technological thinker. Challenged by laboratory activities, students create new ideas and innovations, build systems, and analyze technological products to learn further how and why technology works. They work in groups to build and control systems using engineering design in the development of a technology.

Note: This course may be offered to middle school students for high school credit if approved by the local school division.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Technology Assessment 8407/8406* • Technology Transfer 8405/8404* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Technology Studies 8465 (36 weeks)

Contact the Technology Education Service, Virginia Department of Education, for information on this course. **(Science, Technology, Engineering and Mathematics career cluster)**

Technology Transfer 8405

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

Technology Transfer 8404

Suggested Grade Level(s): 10, 11, 12 (18 weeks)

Prerequisite(s): Technology Foundations 8403

Students work with a variety of computers, materials, and systems to improve their skills and knowledge. Groups work together, applying mathematics, science, and communication concepts, on a project that combines systems such as production, energy, communication, transportation, biotechnology, and other technologies. Thematic activities engage students in community problems where they transfer the technological method to address recycling, space exploration, and housing.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Technology Assessment 8407/8406* • Technology Foundations 8403/8402* **18-week course*	Science, Technology, Engineering and Mathematics	See Section 10 for a listing of applicable credentials (by course name or credential name).

Video and Media Technology 8497

Suggested Grade Level(s): 10, 11, 12 (36 weeks)

This course offers students an opportunity to study all aspects of video and media production, from planning and writing for production to operating studio and editing equipment. Students practice various methods of gathering news and information from individuals, research, and online resources. In addition, students are introduced to analog and digital principles of film production.

Concentration Sequences (a combination of the course above and those below, equivalent to two 36-week courses) **Students wishing to complete a specialization may take additional courses appropriate to their career pathways.**	**Career Cluster(s) for federal reporting (choose one)**	**Available Credentials upon Completion of the Above Course**
• Communication Systems 8415	Arts, Audio/Video Technology and Communications	See Section 10 for a listing of applicable credentials (by course name or credential name).